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ANNUAL REPORT  
OF  
THE DIRECTOR  
OF THE  
MUSEUM OF COMPARATIVE ZOÖLOGY  
AT HARVARD COLLEGE  
TO THE  
PRESIDENT AND FELLOWS OF HARVARD COLLEGE  
FOR  
1916-1917.

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CAMBRIDGE, U. S. A.:  
PRINTED FOR THE MUSEUM.  
1917.



REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUTENANT COMMANDER L. M. GARRETT, U. S. N., COMMANDING, PUBLISHED OR IN PREPARATION: —

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| <p>A. AGASSIZ. V.<sup>5</sup> General Report on the Expedition.</p> <p>A. AGASSIZ. I.<sup>1</sup> Three Letters to Geo. M. Bowers, U. S. Fish Com.</p> <p>H. B. BIGELOW. XVI.<sup>16</sup> The Medusae.</p> <p>H. B. BIGELOW. XXIII.<sup>23</sup> The Siphonophores.</p> <p>H. B. BIGELOW. XXVI.<sup>26</sup> The Ctenophores.</p> <p>R. P. BIGELOW. The Stomatopods.</p> <p>O. CARLGREN. The Actinaria.</p> <p>R. V. CHAMBERLIN. The Annelids.</p> <p>H. L. CLARK. The Holothurians.</p> <p>H. L. CLARK. The Starfishes.</p> <p>H. L. CLARK. XXX.<sup>30</sup> The Ophiurans.</p> <p>S. F. CLARKE. VIII.<sup>8</sup> The Hydroids.</p> <p>W. R. COE. The Nemerteans.</p> <p>L. J. COLE. XIX.<sup>19</sup> The Pycnogonida.</p> <p>W. H. DALL. XIV.<sup>14</sup> The Mollusks.</p> <p>C. R. EASTMAN. VII.<sup>7</sup> The Sharks' Teeth.</p> <p>S. GARMAN. XII.<sup>12</sup> The Reptiles.</p> <p>H. J. HANSEN. The Cirripeds.</p> <p>H. J. HANSEN. XXVII.<sup>27</sup> The Schizopods.</p> <p>S. HENSHAW. The Insects.</p> <p>W. E. HOYLE. The Cephalopods.</p> <p>W. C. KENDALL and L. RADCLIFFE. XXV.<sup>25</sup> The Fishes.</p> <p>C. A. KOFOID. III.<sup>3</sup> IX.<sup>9</sup> XX.<sup>20</sup> The Protozoa.</p> | <p>C. A. KOFOID and J. R. MICHENER. XXII.<sup>22</sup> The Protozoa.</p> <p>C. A. KOFOID and E. J. RIGDEN. XXIV.<sup>24</sup> The Protozoa.</p> <p>P. KRUMBACH. The Sagittae.</p> <p>R. VON LENDENFELD. XXI.<sup>21</sup> The Siliceous Sponges.</p> <p>R. VON LENDENFELD. XXIX.<sup>29</sup> Hexactinellida.</p> <p>G. W. MÜLLER. The Ostracods.</p> <p>JOHN MURRAY and G. V. LEE. XVII.<sup>17</sup> The Bottom Specimens.</p> <p>MARY J. RATHBUN. X.<sup>10</sup> The Crustacea Decapoda.</p> <p>HARRIET RICHARDSON. II.<sup>2</sup> The Isopods.</p> <p>W. E. RITTER. IV.<sup>4</sup> The Tunicates.</p> <p>B. L. ROBINSON. The Plants.</p> <p>G. O. SARS. The Copepods.</p> <p>F. E. SCHULZE. XI.<sup>11</sup> The Xenophyphoras.</p> <p>HARRIET R. SEARLE. XXVIII.<sup>28</sup> Isopods.</p> <p>H. R. SIMROTH. Pteropods, Heteropods.</p> <p>E. C. STARKS. XIII.<sup>13</sup> Atelaxia.</p> <p>TH. STUDER. The Alcyonaria.</p> <p>JH. THIELE. XV.<sup>15</sup> Bathysciadium.</p> <p>T. W. VAUGHAN. VI.<sup>6</sup> The Corals.</p> <p>R. WOLTERECK. XVIII.<sup>18</sup> The Amphipods.</p> |
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<sup>1</sup> Bull. M. C. Z., Vol. XLVI., No. 4, April, 1905, 22 pp.

<sup>2</sup> Bull. M. C. Z., Vol. XLVI., No. 6, July, 1905, 4 pp., 1 pl.

<sup>3</sup> Bull. M. C. Z., Vol. XLVI., No. 9, September, 1905, 5 pp., 1 pl.

<sup>4</sup> Bull. M. C. Z., Vol. XLVI., No. 13, January, 1906, 22 pp., 3 pls.

<sup>5</sup> Mem. M. C. Z., Vol. XXXIII., January, 1906, 90 pp., 96 pls.

<sup>6</sup> Bull. M. C. Z., Vol. L., No. 3, August, 1906, 14 pp., 10 pls.

<sup>7</sup> Bull. M. C. Z., Vol. L., No. 4, November, 1906, 26 pp., 4 pls.

<sup>8</sup> Mem. M. C. Z., Vol. XXXV., No. 1, February, 1907, 20 pp., 15 pls.

<sup>9</sup> Bull. M. C. Z., Vol. L., No. 6, February, 1907, 48 pp., 18 pls.

<sup>10</sup> Mem. M. C. Z., Vol. XXXV., No. 2, August, 1907, 56 pp., 9 pls.

<sup>11</sup> Bull. M. C. Z., Vol. LI., No. 6, November, 1907, 22 pp., 1 pl.

<sup>12</sup> Bull. M. C. Z., Vol. LII., No. 1, June, 1908, 14 pp., 1 pl.

<sup>13</sup> Bull. M. C. Z., Vol. LII., No. 2, July, 1908, 8 pp., 5 pls.

<sup>14</sup> Bull. M. C. Z., Vol. XLIII., No. 6, October, 1908, 285 pp., 22 pls.

<sup>15</sup> Bull. M. C. Z., Vol. LII., No. 5, October, 1908, 11 pp., 2 pls.

<sup>16</sup> Mem. M. C. Z., Vol. XXXVII., February, 1909, 243 pp., 48 pls.

<sup>17</sup> Mem. M. C. Z., Vol. XXXVIII., No. 1, June, 1909, 172 pp., 5 pls., 3 maps.

<sup>18</sup> Bull. M. C. Z., Vol. LII., No. 9, June, 1909, 26 pp., 8 pls.

<sup>19</sup> Bull. M. C. Z., Vol. LII., No. 11, August, 1909, 10 pp., 3 pls.

<sup>20</sup> Bull. M. C. Z., Vol. LII., No. 13, September, 1909, 48 pp., 2 pls.

<sup>21</sup> Mem. M. C. Z., Vol. XLI., August, September, 1910, 323 pp., 56 pls.

<sup>22</sup> Bull. M. C. Z., Vol. LIV., No. 7, August, 1911, 38 pp.

<sup>23</sup> Mem. M. C. Z., Vol. XXXVIII., No. 2, December, 1911, 232 pp., 32 pls.

<sup>24</sup> Bull. M. C. Z., Vol. LIV., No. 10, February, 1912, 16 pp., 2 pls.

<sup>25</sup> Mem. M. C. Z., Vol. XXXV., No. 3, April, 1912, 98 pp., 8 pls.

<sup>26</sup> Bull. M. C. Z., Vol. LIV., No. 12, April, 1912, 38 pp., 2 pls.

<sup>27</sup> Mem. M. C. Z., Vol. XXXV., No. 4, July, 1912, 124 pp., 12 pls.

<sup>28</sup> Bull. M. C. Z., Vol. LVIII., No. 8, August, 1914, 14 pp.

<sup>29</sup> Mem. M. C. Z., Vol. XLII., June, 1915, 397 pp., 109 pls.

<sup>30</sup> Bull. M. C. Z., Vol. LXI., October, 1917, 28 pp., 5 pls.



ANNUAL REPORT  
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CAMBRIDGE, M.

# MUSEUM OF COMPARATIVE ZOÖLOGY.

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GEORGE L. GOODALE.

SAMUEL HENSHAW, *Director.*

JOHN E. THAYER.

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HENRY P. WALCOTT.

GEORGE L. GOODALE.

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# REPORT.

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TO THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE:—

THE Laboratories and Lecture Rooms of the Museum afforded the usual facilities for most of the instruction in Zoölogy, Geology, and Geography offered in Harvard University and in Radcliffe College during the Academic year 1916-1917.

In Zoölogy the nineteen courses and half courses were taken by 410 students in Harvard University and the ten courses and half courses were taken by 98 students in Radcliffe College.

In 1915-1916 these courses and students were:—

*Harvard*:— 20 courses, 377 students.

*Radcliffe*:— 10 courses, 65 students.

The inadequacy of the accommodations for Laboratory work necessitated the exclusion of many students from the elementary course (Zoölogy 1).

In Geology and Geography twenty-eight courses or half courses were offered in Harvard University and two courses were offered in Radcliffe College.

The number of students taking these courses was 703 in Harvard University and 34 in Radcliffe College.

In 1915-1916 these courses and students were:—

*Harvard*:— 27 courses, 515 students.

*Radcliffe*:— 5 courses, 49 students.

In memory of her father, Louis Cabot, Mrs. John W. Bartol has generously given \$5,000. to establish a fund, the income to be used for the purchase of books on travel, sport, and natural history for the Museum Library.

Through the generosity of Mrs. William Barbour, Mrs. I. T. Burr, Mrs. C. G. Weld, Prof. Theodore Lyman, Dr. Thomas Barbour, and the Hon. W. Cameron Forbes, the Museum has been able to have some of its collections rearranged and their nomenclature revised, and also to undertake field-work which has given most interesting results.

Mr. G. K. Noble was appointed Zoölogist of the Expedition to Peru, under the joint auspices of the School of Tropical Medicine and the Museum (Dr. W. L. Moss, *Chief*), by the President and Fellows. Though the actual time spent in the field was limited



to three months, Mr. Noble got together a considerable series of mammals (125 specimens), birds (507 specimens), and reptiles and amphibians (5,000 + specimens); also a few fishes, and interesting invertebrates, among the latter a new species of *Peripatus* (*P. peruvianus* Brues).

Field-work in the West Indies was carried on by Messrs. G. M. Allen (Porto Rico), Thomas Barbour (Cuba), W. S. Brooks (Cuba and the Isle of Pines), J. L. Peters (Anegada, Porto Rico, St. Thomas, Tortola, and the Virgin Islands), and Goodwin Warner (Cuba and the Isle of Pines). The collections made, though chiefly recent reptiles and birds, include a quantity of bones of fossil mammals from the cave deposits of Cuba, the Isle of Pines, and Porto Rico.

Dr. W. M. Mann, on the conclusion of his stay among the Solomon Islands, collected in Australia. His material from the Solomons, though not thoroughly assorted, contains large series of reptiles and land invertebrates, many of which are new to the Museum collections and to science. This is also true of Dr. Mann's Fijian collections, a part of which were but recently received.

Dr. H. L. Clark was enabled, through the kindness of Dr. A. G. Mayer, Director of the Department of Marine Biology of the Carnegie Institution of Washington, to spend the month of June at the Laboratory of the Institution at the Tortugas. His collections, chiefly echinoderms, contain a few species new to science, as well as others of exceptional interest.

Prof. P. E. Raymond continued his field-work in the Middle Ordovician of New York. In his work he was assisted by Mr. T. H. Clark, who, later at Martinsburg, made a large collection of fossils which he has presented to the Museum.

The thanks of the Museum are due Miss Elizabeth B. Bryant for her work upon the collection of Araneina, to Mr. L. W. Swett for his work upon the Geometridae, and to Prof. Carlos de la Torre and to Messrs. J. B. Henderson, Goodwin Warner, and Walter Wilcox who gave most efficient assistance in the field-work in Cuba and the Isle of Pines.

The new accessions to the collection of mammals, about 1,500 specimens, have been identified and catalogued by Dr. G. M. Allen, who has also finished the rearrangement of the rodents and made a beginning of the perissodactyles. Dr. Allen has also spent considerable time in working out from the matrix many hitherto unknown fossils from Cuba and Porto Rico and in describing the same.

Mr. Outram Bangs's constant work during recent years has brought the ornithological collection into thoroughly satisfactory



condition. Arranged according to the Sharpe Hand-list, the entire collection is readily accessible. Mr. Bangs has had the helpful coöperation of Mr. T. E. Penard in some of his research work.

Dr. Barbour reports the accession of an unusual number of species of reptiles and amphibians previously unrepresented in the collection. His field-work and his researches relate chiefly to the fauna of the West Indies.

Mr. Samuel Garman completed his study of the Galapagos tortoises in January and has since identified and rearranged certain groups of fishes. As a temporary Assistant, Mr. Alvin Seale was engaged from 17 October, 1916, until the close of the Museum year; his work consisted of a critical revision including the labeling, cataloguing, and rearrangement of the greater part of the apodal and serranoid fishes, and also a similar work upon a large part of the clupeoid forms.

The permanent staff of the Museum has been strengthened by the appointment of Mr. Nathan Banks as Curator of Insects. During the early years (1863-1867) of the Museum, the entomological collections were in charge of three Assistants, Samuel H. Scudder, Alpheus S. Packard, Jr., and Philip R. Uhler, later three eminent entomologists. In October, 1867, Dr. H. A. Hagen took charge of the collections, and during his term of service which lasted until his death, they were placed in the front rank of University collections. During the fifty years since Dr. Hagen's appointment, the study of insects has become more and more specialized, and the Museum is fortunate in its appointment of an entomologist whose training and interests insure a broad and equitable consideration of the work of his department. Mr. Banks has most generously given to the Museum his private collection of insects and arachnids, and also such of his books and pamphlets which relate to the same as are not already in the Museum Library; of his pamphlets more than 700 have been entered and catalogued. His gift constitutes one of the largest and most valuable entomological collections ever received by the Museum; it includes most of the typical material described by him since 1890, and is especially rich in neuropteroid insects and in the Arachnida.

Dr. R. V. Chamberlin completed his Memoir on the ALBATROSS Annelida Polychaeta, and his manuscript will go to press when the eighty plates are printed. This will naturally require considerable time, but the Alexander Agassiz Expedition Fund enables the work to proceed as fast as practicable.

Mr. W. F. Clapp finished the rearrangement of the Gastropoda,

and catalogued all new accessions and about 2,000 lots of specimens previously received. He estimates that only 1% of the Gastropoda are not catalogued. During the year, Mr. Clapp made a collection of Mollusca and other invertebrates in the ponds and streams of Plymouth County.

Dr. Clark's Museum work consisted of the identification and cataloguing of the new accessions and the preparation of reports upon several collections. The final part of the Memoir on the Hawaiian and other Pacific Echini was published in March, and two reports on collections of ophiurans were completed. The collection of echinoderms contains 2,318 species and nearly 90,000 (89,998) specimens.

Dr. H. B. Bigelow prepared two reports, one on the Medusae and siphonophores collected by the *BACHE* in the western Atlantic, and a second on the results of the 1916 cruise of the *GRAMPUS*.

Professor Raymond continued the rearrangement of the trilobites completing the Agnostidae, Harpedidae, and Goldiidae. He also finished a memoir dealing with the appendages of trilobites, and made a final revision of a report on some new fossils from the Trenton, collected by the Geological Survey of Canada. Professor Raymond assisted the authorities of the Geological Museum of Middlebury College in the identification of their collection of fossils.

Miss Elvira Wood was employed for eight months and continued the revision and arrangement of the study series of Tertiary Gastropoda.

Mr. R. W. Sayles reports that during the winter he was engaged upon a memoir dealing with the relations of the Squantum tillite and the Connecticut River clays. He states that there have been but few accessions received during the year, a record to be qualified by noting that his own munificent donation, George Carroll Curtis's model of the crater of Kilauea, Hawaii, is the most valuable gift ever received by the Geological section of the Museum, and of the highest value for exhibition and for instruction. Like the previous work of Mr. Curtis, it gives a trustworthy representation as to form and color; it is the result of a careful personal survey, supplemented by accurate photographic data, and supported for four consecutive years by patient, generous, and enthusiastic encouragement. The Museum wishes to join with Mr. Sayles in thanking Prof. T. A. Jaggar and Dr. H. O. Wood for the many courtesies shown Mr. Curtis when in Hawaii.

The exceptional skill of Mr. George Nelson in all branches of



taxidermic work, frequently preserves valuable material seemingly beyond repair; this, however, delays the continuous work requisite for the completion of the larger mounts undertaken each year. His notable work this year includes mounts of gigantic Land Tortoises from Aldabra and the Galapagos, an Alligator Snapper and a number of amphibians, reptiles, birds, and mammals. Mr. Nelson also ably assisted Dr. Allen in developing the skeleton of a Mesohippus and repaired and mounted for exhibition many skeletons. He has made many excellent photographs to illustrate the publications of the Museum.

Mr. A. B. Fuller's time has been wholly employed upon the study and exhibition collections of birds and mammals.

Col. John E. Thayer, to whose previous generosity the Museum is indebted for many holographic letters and original drawings of Alexander Wilson and J. J. Audubon, has given additional Wilson drawings and also the gun that belonged to Wilson. This gun, a single-barrelled flintlock, changed to percussion, was subsequently the property of John Cassin, W. P. Turnbull, W. P. Hazard, and J. M. Wade. Free from the danger of fortuitous ownership, this precious relic, still in an excellent state of preservation, is at last properly housed in the Museum. With the gun Colonel Thayer gave the letters relating its history. Colonel Thayer has also given an interesting series of mammal skins from southeastern California, and the original note-books kept by Joseph Dixon in 1913-1914, when collecting birds and mammals for him in the Arctic.

Mr. William Brewster has transferred from his private collection a number of North American birds of the greatest rarity. His gift includes specimens of the California Condor, Heath Hen, and two Labrador Ducks, one a young male and the second an adult female. Long extinct, the Labrador Duck is probably the most valuable of all North American birds; there are more Great Auks than Labrador Ducks known; the species was previously unrepresented in the Museum.

Mr. Edward Doubleday Harris has given several boxes of his fine collection of Cicindelidae (Tiger-beetles). For size, condition of the specimens, neatness and accuracy of the labeling, and for the careful determination of the species, the Harris Collection is not surpassed by any in America. The Museum is deeply indebted to Mr. Harris for the gift of his most valuable collection.

For the valuable Moreno collection of skeletal remains of Ground Sloths from the Pleistocene of Cuba, the Museum is indebted to the

generosity of Dr. Thomas Barbour, and a similar collection of bones of *Isolobodon* from the shell-heaps of Porto Rico is due to the kind interest of Mr. and Mrs. S. K. Lothrop. Dr. Barbour has also given the Museum a fine skeleton of an adult *Tomistoma*, a rare crocodilian from Sarawak.

To Mr. Frank Springer, whose early interest and gifts enhanced the value of the palaeontological collections, the Museum is indebted for a number of species of rare crinoids, mostly species new to the collection.

The Museum is also indebted to Dr. W. L. Smith for a young *Bison*; to Mr. W. T. Hornaday for several *Birds of Paradise*; to Dr. A. G. Ruthven for desirable amphibians and reptiles; to Dr. Hiram Bingham for a series of Peruvian fishes; to Prof. W. M. Wheeler for many interesting land invertebrates, especially, named series of ants; to Messrs. Morgan Hebard and J. A. G. Rehn for many *Orthoptera*, including recently described species; to Mr. E. B. Williamson for types of *Odonata*; to Dr. J. W. Folsom for types of *Collembola*; to Mr. J. H. Emerton for types of spiders; and to the U. S. National Museum for a series of Philippine *Medusae*.

The Library contains 54,427 volumes, and 52,499 pamphlets; 644 volumes and 2,029 pamphlets have been added during the year.

The publications of the year include two numbers of the *Memoirs*, completing volume 30 and volume 46, twelve numbers of the *Bulletin*, and the *Annual Report*, a total of 907 (248 quarto and 659 octavo) pages and 97 (60 quarto and 37 octavo) plates.

One number of the *Bulletin* was published as a *Contribution* from the Zoölogical Laboratory, two numbers as *Contributions* from the Bussey Institution, and nine numbers of the *Bulletin* contain reports on Museum collections or the results of field-work undertaken in the interest of the Museum. The two contributions from the Bussey Institution consist of reports on collections contained in part in the Museum.

One *Memoir* completes the series of reports on the Hawaiian and other Pacific *Echini* (provided for under the Alexander Agassiz Expedition Fund), and the second describes and illustrates the gigantic Land Tortoises of the Galapagos and is based on Museum material.

The Corporation granted \$300. to aid in the publication of *Contributions* from the Zoölogical and Geological Laboratories.

SAMUEL HENSHAW,  
*Director.*



## REPORT ON THE ZOÖLOGICAL LABORATORY.

BY E. L. MARK.

No new courses in Zoölogy were announced for 1916-1917; but the designation of the course on Genetics and Eugenics was changed from Zoölogy 2 to Zoölogy 8. As much the larger number of students taking courses in Zoölogy do their work in the first half-year, the intensive military training and the various war service activities affected only a relatively small proportion of the students. The numbers of those in each of the second half-year courses who took the Zoölogical examinations prepared for the

TABLE I.

Courses 1915-1916	Graduates		Sen.	Jun.	Soph.	Fresh.	Uncl.	ocC.	Sp.	Med. Trop.	Total	R.O. T.C.	Sh Ye
	A. & S.	Ap. S.											
Zoölogy 1	2	1	16	33	59	58	9	1	10	4	193		
" 3	5+2	0+1	8	14	10	8	3	—	4	—	52+3	13	5
" 4	3+2	1	4	7	5	—	—	—	1	—	21+2	—	—
" 5a	1+4	—	4	2	4	—	1	1	—	—	13+4	5	1
" 7a	1	—	—	1	—	—	1	—	—	—	3	1	—
" 7b	1	1	—	—	—	—	2	—	—	—	4	1	—
" 7c	—	—	—	1	—	—	—	—	—	—	1	1	—
" 8 <sup>1</sup>	1	3+1	17	19	9	1	6	2	—	—	58+1	—	—
" 10	2	1+4	1	—	—	—	—	—	—	—	4+4	—	—
" 14b	7+4	—	2	1	1	—	—	2	—	—	13+4	—	—
" 17	1+1	3	—	—	—	—	—	—	—	—	4+1	—	—
" 20a	2	—	—	—	—	—	—	—	—	—	2	1	—
" 20b	1	—	—	—	—	—	—	—	—	—	1	—	—
" 20c	7	—	—	—	—	—	—	—	—	—	7	—	—
" 20d	—	2	1	—	—	—	—	—	—	—	3	—	—
" 20e	3	—	1	1	—	—	—	—	—	—	5	—	—
" 20f	—	5	—	—	—	—	—	—	—	—	5	—	—
" 20g	1	—	—	—	—	—	—	—	—	—	1	—	—
" Special	—	—	1	—	—	—	—	—	—	—	1	—	1
Sums	38+13	17+6	55	79	88	67	22	6	15	4	391+19	22	7

NOTE: Numbers in italics indicate students who attended the lectures, but were not enrolled in the course.

<sup>1</sup> Zoölogy 8 was designated as Zoölogy 2 in the year 1915-16.

TABLE II.

Courses 1915-1916	Gr.	Sen.	Jun.	Soph.	Fresh.	Uncl.	Spec.	Trop. Med.	Total
Zoölogy 1	2	2	6	9	11	5	—	1	36
" 2	—	7	18	11	—	3	—	—	39
" 3	—	—	1	1	1	2	1	—	6
" 4	1	1	3	—	—	—	—	—	5
" 5a	1	1	2	—	—	—	—	—	4
" 14b	1	2	—	—	—	—	—	—	3
" 17	—	1	—	—	—	—	—	—	1
" 20a	1	—	—	—	—	—	—	—	1
" 20c	2	—	—	—	—	—	—	—	2
" 20g	—	1	—	—	—	—	—	—	1
Sums	8	15	30	21	12	10	1	1	98

Reserve Officers Training Corps, and likewise of those credited with the courses on a "short year" on account of war service are indicated in separate columns of Table I, which, as usual, shows the number of students from each class, or other division of the University, enrolled in each of the Harvard courses. Table II gives like information about the number of students from Radcliffe College.

The enrollments in Zoölogy 1 and Zoölogy 3 were larger than in any previous year, and about thirty-five applicants were excluded from Zoölogy 1 for want of adequate laboratory accommodations. The assistants in the several courses were:— Zoölogy 1, Harvard:— chief-assistants, Messrs. S. Hecht and D. E. Minnich; sub-assistants, Messrs. J. P. Baumberger, S. W. Chase, A. B. Dawson, H. Jordan and P. H. Pope; Radcliffe:— chief-assistant, Mr. S. W. Chase, sub-assistant, Mr. A. B. Dawson. Zoölogy 3, Harvard:— chief-assistant, Mr. J. M. D. Olmsted; sub-assistants, Messrs. S. W. Chase and S. Hecht; Radcliffe:— assistant, Mr. A. B. Dawson. Zoölogy 4, Harvard:— assistant, Mr. J. M. D. Olmsted; Radcliffe:— assistant, Mr. A. B. Dawson. Zoölogy 5, Harvard and Radcliffe:— assistant, Mr. A. C. Walton. Zoölogy 8, assistant, Mr. L. C. Dunn.

The courses designated as Zoölogy 7a, 7b, 7c, and 10 were given at the Bussey Institution, the others in Cambridge. Eight of the students in Zoölogy 8 took laboratory work, the others were instead assigned reading with weekly conferences. Of the students



in Zoölogy 14*b*, four in Harvard and one in Radcliffe took the laboratory work, the others presented theses.

In the University Extension Course in Elementary Zoölogy by Professor Parker there were twenty-four students. Mr. H. G. Coar was the assistant.

Work in research, though in several cases interrupted by war demands, was counted as the equivalent of courses as follows:— in Harvard, Zoölogy 20*a* and 20*b*, under Professor Mark, eight courses; Zoölogy 20*c*, under Professor Parker, nine and a half courses; Zoölogy 20*d*, under Professor Castle, one course; Zoölogy 20*e* and 20*g*, under Assistant Professor Rand, seven and a half courses; Zoölogy 20*f*, under Professor Wheeler and Assistant Professor Brues, six courses; in Radcliffe, Zoölogy 20*a*, under Professor Mark, one course; Zoölogy 20*c*, under Professor Parker, two and a half courses; Zoölogy 20*g*, under Assistant Professor Rand, a half course. Courses 20*d* and 20*f* were carried on at the Bussey Institution.

The degree of Ph.D. was conferred in February on Alfred Clarence Redfield, whose thesis was on "The physiology of the melanophores of the horned toad," and in June on Selig Hecht, whose thesis was entitled "The physiology of *Ascidia atra* Lesueur", and on Dwight Elmer Minnich, whose thesis was on "The photic reactions of the honey bee, *Apis mellifera* L. A quantitative study in circus movements."

Owing to the demands of the war, only one Harvard student in addition to the Resident Naturalist was at work at the Bermuda Biological Station during the summer. Aid from the Humboldt Fund to the amount of \$150 was granted during the year.

The Harvard Table at the Marine Biological Laboratory, Woods Hole, was occupied by a research student in physiology, and the Radcliffe table was shared by a Radcliffe Senior, pursuing physiology, and a Radcliffe Junior, who took the course in embryology.

At the twenty-seven meetings held at the Zoölogical Club the average attendance was about 18. Thirty-three original papers and eleven reviews were presented.

Lists of the Contributions from the Zoölogical Laboratory and from the Bermuda Biological Station for Research are given on p. 33-35; other papers by members of the Department are listed under the authors' names.

REPORT OF THE STURGIS HOOPER PROFESSOR OF  
GEOLOGY.

BY REGINALD A. DALY.

While continuing to act as departmental chairman, instruction was given in Geology 4, 9, and 20c.

During the year a paper on the geology of Pigeon Point, Minnesota, two papers on the coral-reef problem, a fourth on the genetic classification of underground volatile agents, and a fifth on the origin of the alkaline rocks, were written and sent to press. The spring and summer months were partly occupied by the instruction of the Harvard Reserve Officers Training Corps in topographic mapping. The remainder of the field-season was devoted to special studies in the serpentine area of Quebec and to continued work on the intrusive masses at Mt. Monadnock, Vermont; at Pleasant Mountain and Burnt Meadow mountains, Maine; and near Litchfield, Maine. At the last-mentioned locality the well-known nephelite syenite, hitherto found only in glacial erratics, was discovered in place, forming dike-like bodies cutting crystalline schists.

In April Dr. Harry Clark delivered the deep-sea thermograph noted in last year's report, thus completing his contract. To defray in part the cost of his honorarium and of manufacture, a second grant of seven hundred dollars was made from the Bache Fund of the National Academy of Sciences. The rest of the cost was, with similar generosity, largely met by liberal gifts from Messrs. Rodolphe L. Agassiz, Livingston Davis, and George B. Leighton, members of the Visiting Committee of the Department of Geology and Geography. Endurance and other tests of the instrument have been satisfactorily made by the writer, though no opportunity has yet been given for tests in deep water.



## REPORT OF THE DEPARTMENT OF GEOLOGY AND GEOGRAPHY.

BY REGINALD A. DALY.

This year the Department was fortunate in having the collaboration of two visiting professors. During the first half-year, Prof. W. S. Tower of the University of Chicago conducted course 3, on the geography of South America, and course 11, on economic geography. The demand for these new courses and the success with which they were administered prove the advisability of securing regular instruction in the same subjects. The payment for Professor Tower's services was secured in part from the Latin American Fund and in part by subscriptions from members of the Visiting Committee.

During the second half-year, Prof. Raoul Blanchard of the University of Grenoble, as exchange professor from France gave, in French, a course (Geography 4) on the geography of the Alps and of certain French cities. His brilliant instruction and the sound philosophy underlying it, like the admirable influence of Professor Tower on our advanced students, made specially vivid the need of at least one professorship of human geography.

During the first half-year, Professor Smyth was on leave of absence. The assistants appointed for the year were:—Messrs. T. H. Clark, J. W. Eggleston, R. M. Field, D. A. Hall, D. H. McLaughlin, M. Noble, Roderick Peattie, Thorndike Saville, W. J. R. Taylor, and B. M. Varney. On January 1st, to the great regret of the Department, Mr. G. M. Flint resigned as preparator, having long served with quite unusual efficiency. The position is now filled by Mr. R. C. Ray, who has, in turn, won the full confidence of the staff. Miss D. Upham's services were of great value in expediting correspondence and stencilling and in the care of the Gardner Collection of lantern slides.

The Faculty of Arts and Sciences voted that under specified conditions, advanced geological courses, taken at the Massachusetts Institute of Technology, may be counted toward the Harvard degrees of A. M. and Ph. D. This vote advances the coöperation

between the two departments, which this year has been signalized by the interchange of both professors and graduate students. During the second half-year and on into the summer months, five professors of the Department gave instruction in topographic mapping to the Harvard Reserve Officers Training Corps.

In April the section of economic geology moved to commodious quarters in Pierce Hall.

The numbers of students taking the different Harvard courses were:

Geology 4	204	Geography 4	11
" 5	50	" 6	22
" 9	6	" 7	11
" 10	10	" 11	18
" 12	2	" 15	60
" 14	2	" 20a	4
" 16	9	Palaeontology 1	9
" 18a	6	" 20	3
" 18b	4	Meteorology 1	52
" 19	4	" 2	4
" 20b	8 (for 13½ courses)	" 3	5
" 20c	1	" 6	2
" 20e	1	" 20	2
Geography 1	191	" 20a	2

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At Radcliffe Geology 4 was given to twenty-two students and Geology 5 to twelve students. The total enrollments at Harvard were 703 as against 515 in 1915-1916 and 232 five years ago; at Radcliffe, twenty-four as against forty-nine in 1915-1916. The number of Harvard courses and half-courses was twenty-eight as against fifteen in 1912-1913.

Owing to war conditions none of the summer courses was given this year. In June the degree of Doctor of Philosophy was conferred on Messrs. D. H. McLaughlin, Alfred Wandtke, and Edward Wigglesworth.

Part of the income of the Whitney Fund was granted to Mr. T. H. Clark, for his stratigraphic investigations in New York State. The Sheldon Fund committee granted to Mr. J. P. Connolly \$650. for his studies of mining camps in the far west.

The fund given by Dr. W. S. Bigelow, noted last year, was again most useful, defraying the travelling expenses of three visiting lecturers, Professor Scott of Princeton, Professor de Martonne of Paris, and Professor Barrell of Yale.



Mr. Wigglesworth reports on the Gardner Collection of photographs and lantern slides, as follows:

	Photographs	Slides
Accessions since last year	1	621
Unidentified views	150	0
Duplicates	116	0
Broken	0	2
Last accession number	7,855	10,060
Number now in collection	7,744	10,060
Card catalogued	0	9,550

The most valuable accession of recent years is a set of 430 lantern slides of the French Alps and the Pyrenees, the gift of Professor Raoul Blanchard. Professor McAdie presented a small set of slides of exceptional merit, illustrating frost formation. The slides given by the Australian Commonwealth mentioned in the last report have been catalogued.

Owing to other duties, Mr. Wigglesworth resigned the curatorship of the Gardner Collection. The Department heartily regrets this and records its gratitude for his unselfish devotion.

Professor Woodworth gave the Harvard courses, Geology 5, 12, 19, and 20e and the Radcliffe courses, Geology 4 and 5. Owing to his work on the geology of Cape Cod and the islands along the Massachusetts coast for the U. S. G. S., he was not able to maintain the monthly issues of the seismographic records; during the latter half of the year 1916, the records of the Harvard station were kindly deciphered and published by the U. S. Weather Bureau. Room 55 in the Geological Section of the Museum has been fitted up for laboratory work in Professor Woodworth's advanced courses. As a member of the committee on geology and palaeontology of the National Research Council and as chairman of the subcommittee on the use of seismographs in war, Professor Woodworth devoted much time to those services.

Professor Atwood conducted the geographical courses numbered 1, 6, 7, and 20a. In coöperation with Mr. Peattie he prepared papers entitled "Saving the silts of the Mississippi" and the "Relation of landslide and glacial deposits to reservoir sites in the San Juan Mountains". He continued his work on the more comprehensive report, covering the physiography of the San Juan Mountains, Colorado.

Professor Raymond conducted the courses Palaeontology 1, 20, Geology 14; and gave one lecture each week in Geology 5. Geology 14 was given for the first time.

Through the assistance of Messrs. Robert W. Sayles and Richard M. Field, the Department was enabled to purchase a modern microphotographic apparatus for use in stratigraphic geology. Mr. Field also contributed toward the fitting up of the dark room.

Having been granted an allotment from the Shaler Memorial Fund for an investigation of the stratigraphy of the Ordovician strata of the Appalachians, Professor Raymond spent two months in the field in Pennsylvania and Virginia. Numerous sections were studied and much information obtained as to the faunas and geographic extent of various formations. In this work, Mr. Richard M. Field of Brown University, Dr. E. W. Shuler of Southern Methodist University, and Prof. S. L. Powell of Roanoke College, coöperated.

Geology 10, conducted chiefly by Professor Graton, included also lectures on iron ores by Professor Smyth and lectures on gold and silver by Professor W. Lindgren of the Massachusetts Institute of Technology. In reciprocation, Professor Graton gave a course on ore deposits at the Institute during the second half year. These arrangements illustrate the progress being made in the highly desirable coöperation between the Harvard and Technology Departments of Geology. Geology 18 of former years was divided into two half courses, Geology 18*a* being given by Professors Palache and Wolff and Geology 18*b* by Professor Graton, with lectures on coal by Professor Jeffrey of the Department of Botany and on petroleum by Mr. W. F. Jones of the Institute of Technology. Under direction from Professor Graton, two graduate students devoted the entire summer to field-work.

As heretofore, the principal subjects of research in Economic Geology are among those related to the study of secondary enrichment of copper ores. A thesis entitled "Occurrence and significance of bornite" by Dr. D. H. McLaughlin, accepted for the doctorate, will be published as a number of separate articles, one of which has already appeared. Mr. J. P. Connolly began an investigation on ore occurrence in limestones and Mr. D. A. Hall continued his study of the ore deposits at Butte, Montana.

Through the interest and generosity of alumni, there was made available for the work in Economic Geology during the year the sum of \$3,000. which has been devoted to the improvement and increase of equipment and facilities for instruction. A similar



sum has been pledged for a number of years to come and should enable the instruction in this branch to be made very much more effective than has been possible heretofore.

Professor Ward gave his usual meteorological courses. In May, at the request of President Maclaurin, he was assigned to the teaching staff of the Massachusetts Institute of Technology and has since then, under the direction of the War Department, given regular instruction in meteorology in the United States Army School of Military Aëronautics at the Institute. By direction of the Chief Signal Officer, Professor Ward has prepared an outline of his lectures on meteorology in relation to aviation, to serve as a text in all the Schools of Military Aëronautics. As President of the Association of American Geographers, Professor Ward devoted considerable time to the affairs of that organization. He is also a member of the Geography Committee of the National Research Council. During March, as visiting Lecturer in the Department of Geography of the University of Wisconsin, he gave a course on climatological subjects. Special attention has been paid to the effects of weather conditions upon military operations in the War, and several papers have been published on this subject. Professor Ward has also prepared a second edition of his "Climate" which is now in press.

## REPORT ON THE MAMMALS.

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BY OUTRAM BANGS.

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During the year, the larger collections received were:— remains of land mammals from cave deposits and recent mammals from Cuba, collected by Prof. Carlos de la Torre, Dr. Thomas Barbour, Messrs. W. S. Brooks and Goodwin Warner, about 250 specimens: remains of *Isolobodon* from Porto Rico, collected by Mr. and Mrs. S. K. Lothrop, about 50 specimens; remains of five other extinct Porto Rican genera, collected by Dr. G. M. Allen and Mr. J. L. Peters; an important collection of bones of Cuban ground sloths from Dr. Barbour, about 220 pieces; 175 skulls and other bones of seals from Greenland, from the Peabody Museum; 100 alcoholic bats from Cuba from Professor de la Torre; 90 skins and skulls from southeastern California, from Col. John E. Thayer; 125 skins and alcoholics from northwestern Peru, collected by Mr. G. K. Noble, as Zoölogist of the Expedition to Peru.

In exchange there have been received, 17 fossil specimens from Patagonia and the early Tertiary of North America, from the Museum of Amherst College; a rare monkey, *Preslytis potenziani*; and two examples of the Porto Rican bat, *Erophylla portoricensis*, both species new to the collection, from the U. S. National Museum.

Specimens have been loaned for study to nine persons.

Single specimens, or small series of specimens have been received from Messrs. G. M. Allen, Thomas Barbour, William Brewster, G. C. Deane, J. W. Elliot, T. R. Fisher, A. B. Fuller, R. T. Jackson, J. E. Law, Theodore Lyman, W. M. Mann, R. M. Marble, George Nelson, J. L. Peters, J. B. Rorer, J. E. Thayer, Carlos de la Torre, C. W. Townsend, and J. B. Woodworth; also from Mrs. A. T. Friend, Mr. and Mrs. S. K. Lothrop, the Florida Amalgamated Phosphate Company, the Boston Society of Natural History, the Peabody Museum, and the Shaler Memorial Expedition.



## REPORT ON THE BIRDS.

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BY WILLIAM BREWSTER.

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The total number of bird skins acquired during the year falls somewhat short of 1,000 — or, to be more precise, is about 940. Of these, 507 representing 149 species and subspecies, of which 73 are new to the Museum and several equally so to science, were obtained in northwestern Peru by Mr. G. K. Noble while associated with the Expedition to Peru. Early in this same year Messrs. Barbour, Brooks, and Warner collected, in Cuba and the Isle of Pines, 164 birds many of which possess exceptional rarity or interest.

The Curator has transferred to the Museum, by gift from his private collection, a pair of Labrador Ducks, five California Condors, four Heath Hens and some other North American birds together with 172 specimens originally given him by the late Dr. James C. Merrill, U. S. A., who collected them, during years now long since past, while stationed at various western army posts including Edinburgh and Fort Brown, Texas, Fort Sherman, Idaho, and Fort Reno, Indian Territory.

Two House Sparrows, *Passer domesticus* (Linné), received from Drs. Walter Faxon and W. M. Tyler deserve especial mention because of their peculiar coloration. This is very generally bright vinaceous russet tinged here and there with rosy and shading into bright terracotta or testaceous on the wing-bars, sides of throat, and middle of belly. These tints pigment the skins as well as the plumage. Both birds were members of a large flock of normally colored Sparrows which frequented a poultry yard at Lexington, Mass., in March, 1917.

For gifts of bird skins in small series or singly the Museum is indebted to Miss Mabel P. Cook, to the Massachusetts Commissioner of Fisheries and Game (for a Heath Hen from Martha's Vineyard), to the New York Zoölogical Society, and to Messrs. Outram Bangs, E. N. Fischer, A. B. Fuller, George Nelson, T. E. Penard, J. L. Peters, J. C. Phillips, W. M. Tyler, and C. C. Willoughby. By exchange we have received from the Brooklyn

Institute three birds taken at South Georgia Island; from the United States National Museum thirty specimens collected in the Celebes, Philippines, Nicobar, and Simalu Islands, representing eleven species of which eight are new to us. Twelve bird skins have been sent in exchange to the National Museum of Ireland; three to the Brooklyn Institute; and one to the Boston Society of Natural History.

For scientific study we have loaned 115 bird skins to Dr. W. E. Clyde Todd, twenty-seven to Mr. C. B. Cory, twenty-five to Dr. F. M. Chapman, eleven to Dr. Jonathan Dwight, Jr., five to Dr. C. W. Richmond, four to Mr. H. C. Oberholser, three to Mr. C. K. Coale, two to Mr. C. R. Murphy, while 32 have been submitted to Mr. L. A. Fuertes to serve for purposes of illustrations.



## REPORT ON THE REPTILES AND AMPHIBIANS.

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BY THOMAS BARBOUR.

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The year has been a most eventful one for this Department, and an unusual number of species previously unrepresented in the collection have been received. Chief among these was the splendid series secured by Dr. W. M. Mann in the Fiji and Solomon Islands.

Dr. G. M. Allen and Mr. J. L. Peters secured some interesting species in Porto Rico. Mr. Peters subsequently collected desirable forms on Anegada, Tortola, and Virgin Gorda. He also visited St. Thomas and some of the smaller islets. The Associate Curator visited Cuba during January-March, and had the enthusiastic and untiring aid of Messrs. W. S. Brooks and Goodwin Warner. These gentlemen also spent several weeks in the Isle of Pines, and secured there additional material. Dr. Ruthven of the University of Michigan has continued his very kind gifts of paratypes of the new forms which he describes from South America. Many other valued specimens have been received from him in exchange.

Through unusual good fortune, a fine skeleton of an adult *Tomistoma* from Sarawak was obtained, as also specimens of the excessively rare *Hyla lichenata* from Jamaica. Some rare North American species collected in Arizona were also purchased. But few exchanges were completed this year, these having been with the U. S. National Museum, the University of Michigan Museum, and the Academy of Natural Sciences, Philadelphia. Each of these institutions has likewise loaned and borrowed material for study. Thanks are due to Dr. M. Grabham of Jamaica and Dr. A. W. Sellards of the Harvard Medical School for welcome gifts.

## REPORT ON THE FISHES.

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BY SAMUEL GARMAN.

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The most important additions were the gifts of South American fishes by Dr. Hiram Bingham, many of them cotypes from descriptions by Eigenmann; a fine series of Bermudan fishes donated by the Bermuda Biological Station for Research; and a very interesting lot of the species frequenting the coral reefs of the Solomon Islands, collected by Dr. W. M. Mann.

The usual amount of attention has been devoted to the care of the collections, that is, to the regular work demanded by the Department.

Mr. Alvin Seale has worked over a large part of the eels and Serranidae.

By exchanges and by purchases the Museum has brought together one of the best series known of the Giant Tortoises of the Galapagos Islands; this provided for my memoir, The Galapagos Tortoises (Mem. M. C. Z., 30, no. 4).



## REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

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BY NATHAN BANKS.

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During the eight months the present Curator has been in charge, much of his time has been spent in becoming acquainted with the collection and its arrangement. The collection has been examined for pests and fumigated where necessary. A considerable amount of material in Hymenoptera and Hemiptera has been pinned, and most of the unmounted Odonata are now pinned and spread. The miscellaneous insects collected some years since by Mr. A. P. Morse in the Southern States and in New England, have been mounted, and much of Dr. Barbour's East Indian collection has also been pinned. The Hymenoptera, Diptera, and Hemiptera in a number of miscellaneous collections have been assorted and placed in the main collection.

The Psammocharidae, Scoliidae, and Philanthidae have been studied, and the new species described; the Psammocharidae of Cornell University have been determined for the desirable duplicates, and the collection of Prof. C. T. Brues in this family, kindly presented to the Museum, has also been identified.

In the Diptera the Asilidae have been partly studied and the genera *Dasyllis* and *Dioctria* revised and the results published. In the Neuroptera various species of *Myrmeleonidae* and *Termitidae* have been examined.

The accessions have been very large. The Curator's collections contain fully 60,000 pinned insects and more than 60,000 Arachnida. This, with that already in the Museum, makes the Museum collections in the Neuroptera and Arachnida more important than the combined collections of these groups in this country. In the Neuroptera the Curator's collection contains nearly 900 types, and about as many in the Arachnida, with over two hundred additional types in other orders of insects. This collection materially increases the Museum collection in Hymenoptera, Diptera, and Hemiptera. The Curator has collected a thousand or more specimens in the vicinity of Lexington, Mass.

Valuable donations of insects have been received from Messrs.

C. F. Baker, J. C. Bradley, H. Brauns, C. T. Brues, F. Campos, J. H. Emerton, F. Grinnell, H. R. Hagan, E. D. Harris, C. Gordon Hewitt, R. C. Smith, E. W. Thompson, W. M. Wheeler, E. B. Williamson, and a fine collection of Cuban insects from Dr. Thomas Barbour.

Specimens in exchange were received from Messrs. R. J. Tillyard and E. Petersen.

The purchases include several families of the G. Birkmann collection of Hymenoptera and the collection of Diptera (largely Tachinidae) of Mr. Harrison E. Smith.

Specimens were loaned for study to Messrs. J. M. Aldrich (Anthomyidae), C. P. Alexander (Tipulidae), C. T. Brues (Serphidae), E. A. Chapin (Cleridae), G. H. Chapman (Buprestidae), F. C. Cole (Cyrtidae), J. H. Comstock (Myiodactylus), G. C. Crampton (Merope and other Neuroptera), C. L. Kennedy (Odonata), J. R. Malloch (Tiphia), H. M. Parshley (Tingidae and Aradidae), J. C. Root (Coccinellidae), and H. E. Smith (Tachinidae).

Mr. L. W. Swett has kindly continued his work on Geometridae.



## REPORT ON THE MYRIOPODS, ARACHNIDS, AND WORMS.

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BY RALPH V. CHAMBERLIN.

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Accessions of chilopods and diplopods were received during the year from Messrs. J. W. Bailey, (from Louisiana), H. L. Clark, R. T. Cotton, C. R. Crosby, W. J. Crozier, Harold Cummins, (about Nashville, Tenn.), J. H. Emerton, Harold Heath, W. C. Henderson, W. Hilton, Chas. F. Horan, L. O. Howard, C. A. Kofoid, W. M. Mann, P. S. Parrott, Phil. Rau, C. B. Williams.

Specimens of arachnids were received from Miss E. B. Bryant, Messrs. S. C. Chamberlin, H. L. Clark, W. M. Mann, and C. B. Williams.

Gifts of worms were received from Messrs. H. B. Bigelow, H. L. Clark, Thurlow C. Nelson, and Max H. Ruhmann.

Aside from routine work on various small collections of myriopods and arachnids received for identification, and some days in August spent in field-work in the Wahsatch Mts., my time during the year was almost wholly devoted to the completion of a report on the annelids of the Albatross expeditions of 1891, 1899-1900, and 1904-1905.

## REPORT ON THE ECHINODERMS.

BY HUBERT LYMAN CLARK.

The routine work has consisted chiefly of the identification and cataloguing of the extensive additions received from various sources. These additions total nearly 3,300 specimens.

Aside from this work, the preparation of reports has occupied the time. The monograph of Recent Echini begun by Mr. Agassiz and myself in 1904 was completed and the final portion, Part 6, dealing with the spatangoids, was published in March. This part contains an index to the entire work. Reports were also completed on the ophiurans collected by the ALBATROSS in 1899-1900 and in 1904-1905, and on new or notable ophiurans in the M. C. Z. collection. Progress has also been made on a monograph on the echinoderms of South Africa.

The month of June was spent at the Tortugas Laboratory of the Carnegie Institution, where more than 800 specimens of 71 species of echinoderms were collected, half a dozen of which are new, not only to the M. C. Z. collection, but apparently to science also. Some very interesting additional species were collected near Key West, Florida. Besides this material, which has been identified and catalogued, the chief accessions of the year were the collection from Tobago (referred to in last year's report) and series of spatangoids and of holothurians from the U. S. National Museum, in return for the identification of material. Specimens were received from Messrs. F. N. Balch, W. J. Crozier, W. A. Hilton, E. G. Humphrey, R. T. Jackson, W. M. Mann, A. G. Mayer, Alvin Seale, and D. Thaanum. At the end of the year, the collection of echinoderms was made up as follows:—

	No. of Genera	No. of Species	No. of Specimens
Crinoids	45	164	2,936
Asteroids	122	538	12,973
Ophiurans	144	777	24,351
Echini	132	467	44,620
Holothurians	59	372	5,118
Totals	502	2318	89,998



Comparison of this table with that published in the Museum Report five years ago shows an increase of 11% in number of specimens, 14% in number of species and 19% in number of genera.

## REPORT ON THE COELENTERATES.

BY HENRY B. BIGELOW.

The most important accession to the collection is a series of hydroids from British Columbia, from Dr. C. McLean Fraser, including many species not previously represented in the Museum. Bermudan Medusae have been presented by Dr. W. J. Crozier, and specimens from the Gulf of Mexico by Mr. Percy Viasco.

My chief work has been the preparation of a report on the Medusae and siphonophores collected by the U. S. Coast and Geodetic steamer *BACHE* during her cruise in the western Atlantic in 1914, and the working up of the results of the *GRAMPUS* cruise of 1916.

During the winter, in collaboration with the Interdepartmental Board on International Ice observation and Patrol in the North Atlantic, a program of oceanographic work was laid out for the coast guard steamer *SENECA*, to be carried out during her ice survey of the Grand Banks. But the outbreak of the war caused its temporary abandonment.



## REPORT ON INVERTEBRATE PALAEONTOLOGY.

BY PERCY E. RAYMOND.

The rearrangement of the collection of trilobites has been continued during the year, and the Agnostidae, Harpedidae, and Goldiidae finished. The study of the Agnostidae brought out new points in connection with the classification of the trilobites which were discussed in an article published in the American Journal of Science. Some time was given to the final revision of an article describing a number of new species of fossils from the Trenton, collected by the writer and his assistant while members of the Geological Survey of Canada. The major research of the year relates to the appendages of trilobites, the unique material in the Yale University Museum having been put at my disposal for the purpose of gathering together for one publication all at present known concerning the morphology of these organisms. The results of this study will be published as a memoir by the Connecticut Academy of Arts and Sciences.

In September, 1916, I spent a week in collecting fossils from the middle Ordovician formations of the Mohawk and Black River valleys in New York, being accompanied by Mr. T. H. Clark, who remained at Martinsburg for two weeks after my return, and made a large collection, which he has presented to the Museum.

In June of this year, on the invitation of a former student, Prof. W. G. Foye, I spent a week in Vermont, devoting a part of the time to field-work, and a part to the identification of fossils in the Geological Museum of Middlebury College. In exchange for my assistance in this work, the Museum received a good assortment of duplicates from their material, including many specimens new to the collection.

In addition to material collected by the Curator, the Museum has received during the year three drawers of Ordovician fossils from Dr. Sidney Powers, one lot of Carboniferous and one lot of Eocene fossils from Dr. D. C. Barton, and one drawer of Triassic fossils from Dr. Alfred Wandtke. Prof. S. L. Powell has also sent four boxes of Ordovician fossils from Virginia.

## REPORT ON THE GEOLOGICAL COLLECTION.

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BY ROBERT W. SAYLES.

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During the past year there have been few accessions to the collections. In July, a collection of sand-blasted pebbles was made near Highland Light on Cape Cod. In August, September, and October, an investigation of the annual layers in the glacial clays of the Connecticut Valley was undertaken, for a comparison with the annual layers in the glacial slate at Squantum peninsula. From Hanover, N. H., northward for about fifty miles, clays were examined on both sides of the river. Practically all the phenomena observed in the Squantum glacial slate was found also in these clays of the Connecticut River Valley. During the winter, almost the entire time was used in writing a memoir, of a comparative nature, on the Squantum slate and the Connecticut River clays. In conjunction with this work in the Connecticut Valley, many specimens of the annual layers of the clays were taken for exhibition purposes. Some of these have folds due to glacial over-riding. A large number of clay concretions of unusual shapes were collected at Woodsville.

The Museum is indebted to Prof. E. L. Mark for some specimens of calcareous rock of aeolian origin used for building purposes in Bermuda, to Dr. Laurence LaForge, for the first striated pebble found in the tillite at Hyde Park, and to Professors Woodworth and Palache for other desirable gifts.

In June, the Kilauea model, made by Mr. George C. Curtis, a gift of the Curator, was formally exhibited at a private view to members of the University interested in the Geological section of the Museum.



REPORT ON THE LIBRARY.

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During the Museum year from August, 1, 1916, to July 31, 1917, inclusive, 644 volumes, 1,225 parts of volumes, and 2,029 pamphlets have been added to the Library.

The total number of volumes in the Library is 54,427, the total number of pamphlets is 52,499.

Four hundred and twenty-three volumes have been bound; twelve hundred pamphlets have been separately bound.

## PUBLICATIONS

FOR THE YEAR 1916-1917

(1 AUGUST, 1916-31 JULY, 1917)

MUSEUM OF COMPARATIVE ZOOLOGY.

## BULLETIN:—

## Vol. LVII.

- No. 4. The lithobiid genera *Oabius*, *Kiberbius*, *Paobius*, *Arebius*, *Nothembius*, and *Tigobius*. By Ralph V. Chamberlin. pp. 90. 10 Plates. October, 1916.

## Vol. LX.

- No. 10. The resident birds of Guadeloupe. By G. K. Noble. pp. 40. August, 1916.
- No. 11. The Stanford Expedition to Brazil, 1911, John C. Branner, Director. The ants of Brazil. By William M. Mann. pp. 94. 7 Plates. September, 1916.
- No. 12. The fossil Elateridae of Florissant. By H. F. Wickham. pp. 37. 7 Plates. October, 1916.

## Vol. LXI.

- No. 1. New fossil mammals from Cuba. By G. M. Allen. pp. 12. 1 Plate. January, 1917.
- No. 2. The ants of Alaska. By William Morton Wheeler. pp. 10. March, 1917.
- No. 3. New spiders of the family Aviculariidae. By Ralph V. Chamberlin. pp. 54. 5 Plates. April, 1917.
- No. 4. New species of apodal fishes. By Alvin Seale. pp. 18. May, 1917.
- No. 5. New fossorial Hymenoptera. By Nathan Banks. pp. 22. May, 1917.
- No. 6. The introduction of West Indian *Anura* into Bermuda. By P. H. Pope. pp. 16. 2 Plates. June, 1917.
- No. 7. Notes on some Falkland Island birds. By W. Sprague Brooks. pp. 28. 3 Plates. June, 1917.
- No. 8. Explorations of the coast water between Cape Cod and Halifax in 1914 and 1915, by the U. S. Fisheries Schooner *Grampus*. Oceanography and plankton. By Henry B. Bigelow. pp. 198. 2 Plates. July, 1917.



## MEMOIRS:—

Vol. XXX.

- No. 4. The Galapagos tortoises. By Samuel Garman. pp. 40. 42  
Plates. January, 1917.

Vol. XLVI.

- No. 2. Hawaiian and other Pacific Echini. The Echinoneidae, Nucleolitidae, Urechinidae, Echinocorythidae, Calymnidae, Pourtalesiidae, Palaeostomatidae, Aeropsidae, Palaeopneustidae, Hemiasteridae, and Spatangidae. By Hubert Lyman Clark. pp. 203. 18 Plates. March, 1917.

## REPORT:—

- 1915-1916. pp. 40. December, 1916.

## ZOÖLOGICAL LABORATORY.

## CONTRIBUTIONS:—

277. WENRICH, D. H.— Notes on the reactions of bivalve mollusks to changes in light intensity: Image formation in *Pecten*. *Journ. animal behav.*, July-August, 1916, **6**, p. 297-318.
278. AREY, L. B.— The influence of light and temperature upon the migration of the retinal pigment of *Planorbis trivolvis*. *Journ. comp. neurol.*, August, 1916, **26**, p. 359-389, 1 pl.
279. WALTON, A. C.— Reactions of *Paramoecium caudatum* to light. *Journ. animal behav.*, September-October, 1916, **6**, p. 335-340.
280. WALTON, A. C.— The 'refractive body' and the 'mitochondria' of *Ascaris canis* Werner. *Proc. Amer. acad. arts & sci.*, October, 1916, **52**, p. 253-266, 2 pls.
281. PARKER, G. H. AND TITUS, E. G.— The structure of *Metridium* (*Actinoloba*) *marginatum* Milne Edwards with special reference to its neuro-muscular mechanism. *Journ. exper. zoöl.*, November, 1916, **21**, p. 433-459, 1 pl.
282. PARKER, G. H.— The effector systems of actinians. *Journ. exper. zoöl.*, November, 1916, **21**, p. 461-484.
283. WALTON, A. C.— A case of the occurrence of *Ascaris triquetra* Schrank in dogs. *Journ. parasitol.*, September, [November], 1916, **3**, p. 39-41.
284. PARKER, G. H.— Nervous transmission in the actinians. *Journ. exper. zoöl.*, January, 1917, **22**, p. 87-94.
285. PARKER, G. H.— The movements of the tentacles in actinians. *Journ. exper. zoöl.*, January, 1917, **22**, p. 95-110.
286. PARKER, G. H.— Pedal locomotion in actinians. *Journ. exper. zoöl.*, January, 1917, **22**, p. 111-124.
287. PARKER, G. H.— The responses of hydroids to gravity. *Proc. Nat. acad. sci.*, February, 1917, **3**, p. 72-73.

288. COLE, W. H.—The reactions of *Drosophila ampelophila* Loew to gravity, centrifugation and air currents. *Journ. animal behav.*, January–February, 1917, **7**, p. 71–80.
289. OLMSTED, J. M. D.—Geotropism in *Planaria maculata*. *Journ. animal behav.*, January–February, 1917, **7**, p. 81–86.
290. PARKER, G. H.—Actinian behavior. *Journ. exper. zool.*, February, 1917, **22**, p. 193–229.
291. REDFIELD, E. S. P.—The rhythmic contractions in the mantle of lamellibranchs. *Journ. exper. zool.*, February, 1917, **22**, p. 231–239.
292. REDFIELD, A. C.—The reactions of the melanophores of the horned toad. *Proc. Nat. acad. sci.*, March, 1917, **3**, p. 202–203.
293. REDFIELD, A. C.—The coördination of the melanophore reactions of the horned toad. *Proc. Nat. acad. sci.*, March, 1917, **3**, p. 204–205.
294. POPE, P. H.—See *supra*, *Bull.* **61**, no. 6.

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##### CONTRIBUTIONS:—

46. CROZIER, W. J.—The taste of acids. *Journ. comp. neurol.*, August, 1916, **26**, p. 453–462.
47. WENRICH, D. H.—See *supra*, *Contrib. Zoöl. Lab.*, **277**.
48. CROZIER, W. J.—Cell penetration by acids. II. Further observations on the blue pigment of *Chromodoris zebra*. *Journ. biol. chem.*, September, 1916, **26**, p. 217–224.
49. CROZIER, W. J.—Cell penetration by acids. III. Data on some additional acids. *Journ. biol. chem.*, September, 1916, **26**, p. 225–230.
50. CROZIER, W. J.—On a barnacle, *Conchoderma virgatum*, attached to a fish, *Diodon hystrix*. *Amer. nat.*, October, 1916, **50**, p. 636–639.
51. CROZIER, W. J.—On the immunity coloration of some nudibranchs. *Proc. Nat. acad. sci.*, December, 1916, **2**, p. 672–675.
52. AREY, L. B.—The sensory potentialities of the nudibranch 'rhinophore.' *Anat. record*, January, 1917, **11**, p. 514–516.
53. CROZIER, W. J.—Studies on *Amphioxus*. By E. L. Mark and W. J. Crozier. I. The photoreceptors of *Amphioxus*. *Anat. record*, January, 1917, **11**, p. 520.
54. PARKER, G. H.—See *supra*, *Contrib. Zoöl. Lab.*, **285**.



55. PARKER, G. H.— See *supra*, *Contrib. Zoöl. Lab.*, **286**.
56. JORDAN, H.— Rheotropism of *Epinephelus striatus* Bloch. *Proc. Nat. acad. sci.*, March, 1917, **3**, p. 157–159.
57. CROZIER, W. J.— The nature of the conical bodies on the mantle of certain nudibranchs. *Nautilus*, January, 1917, **30**, p. 103–106.
58. WALTON, A. C.— A case of regeneration in *Panulirus argus*. *Amer. nat.*, May, 1917, **51**, p. 308–310.
59. CROZIER, W. J.— On the periodic shoreward migrations of tropical nudibranchs. *Amer. nat.*, June, 1917, **51**, p. 377–382.
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61. CROZIER, W. J.— Occurrence of a holothurian new to the fauna of Bermuda. *Ann. mag. nat. hist.*, May, 1917, **19**, p. 405–406.
62. CROZIER, W. J.— On the pigmentation of a polyclad. *Proc. Amer. acad. arts & sci.*, May, 1917, **52**, p. 723–730, 1 pl.
63. POPE, P. H.— See *supra*, *Bull.* **61**, no. 6: *Contrib. Zoöl. Lab.*, **294**.
64. CROZIER, W. J.— Some structural variations in *Chromodoris zebra*. *Nautilus*, April, 1917, **30**, p. 140–142.
65. CROZIER, W. J.— A method of preserving large nudibranchs. *Nautilus*, April, 1917, **30**, p. 142–144.
66. CROZIER, W. J.— Multiplication by fission in holothurians. *Amer. nat.*, September, 1917, **51**, p. 560–566.
67. JORDAN, H.— Rheotropic responses of *Epinephelus striatus* Bloch. *Amer. journ. physiol.*, June, 1917, **43**, p. 438–454.
68. CROZIER, W. J.— The behavior of holothurians in balanced illumination. *Amer. journ. physiol.*, July, 1917, **43**, p. 510–513.

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See p. 32. *Bull.* **61**, no. 2.



## INVESTED FUNDS OF THE MUSEUM.

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The payments on account of the Museum are made by the Bursar of Harvard College, on vouchers approved by the Director. The accounts are annually examined by a committee of the Overseers. The only funds the incomes of which are restricted, the Gray, the Humboldt, the Whitney, the Louis Cabot, and the Alexander Agassiz Expedition Funds, are annually charged in an analysis of the accounts, with vouchers, to the payment of which the incomes are applicable.

The income of the Gray Fund can be applied to the purchase and maintenance of collections, but not for salaries.

The income of the Humboldt Fund (about \$400.) can be applied for the benefit of one or more students of Natural History, either at the Museum, the United States Fish Commission Station at Woods Hole, the Stations at Bermuda, or the Tortugas.

The income of the Whitney Funds can be applied for the care (binding) and increase of the Whitney Library.

The income of the Louis Cabot Fund can be applied to the purchase of books on travel, sport, and natural history.

The Alexander Agassiz Expedition Fund was bequeathed by Alexander Agassiz for the publication of reports on collections brought together by the expeditions with which he was connected.

The income of the Virginia Barret Gibbs Scholarship Fund, of the value of \$325., is assigned annually with the approval of the Faculty of the Museum, on the recommendation of the Professors of Zoölogy and of Comparative Anatomy in Harvard University, "in supporting or assisting to support one or more students who may have shown decided talents in Zoölogy, and preferably in the direction of Marine Zoölogy."

Applications for the tables reserved for advanced students at the Woods Hole Station should be made to the Faculty of the Museum before the 1st of May. Applicants should state their qualifications, and indicate the course of study they intend to pursue.





The following Publications of the Museum of Comparative Zoölogy are in preparation:—

LOUIS CABOT. Immature State of the Odonata, Part IV.

E. L. MARK. Studies on Lepidosteus, continued.

E. L. MARK. On Arachnactis.

Reports on the Results of Dredging Operations in 1877, 1878, 1879, and 1880, in charge of ALEXANDER AGASSIZ, by the U. S. Coast Survey Steamer "Blake," as follows:—

A. MILNE EDWARDS and E. L. BOUVIER. The Crustacea of the "Blake."

A. E. VERRILL. The Alcyonaria of the "Blake."

Reports on the Results of the Expedition of 1891 of the U. S. Fish Commission Steamer "Albatross," Lieutenant Commander Z. L. TANNER, U. S. N., Commanding, in charge of ALEXANDER AGASSIZ, as follows:—

K. BRANDT. The Sagittae.

K. BRANDT. The Thalassicolae.

O. CARLGREN. The Actinarians.

R. V. CHAMBERLIN. The Annelids.

W. R. COE. The Nemerteans.

REINHARD DOHRN. The Eyes of Deep-Sea Crustacea.

H. J. HANSEN. The Cirripeds.

H. J. HANSEN. The Schizopods.

HAROLD HEATH. Solenogaster.

W. A. HERDMAN. The Ascidians.

S. J. HICKSON. The Antipathids.

E. L. MARK. Branchiocerianthus.

JOHN MURRAY. The Bottom Specimens.

P. SCHIEMENZ. The Pteropods and Heteropods.

THEO. STUDER. The Alcyonarians.

— The Salpidae and Doliolidae.

H. B. WARD. The Sipunculids.

Reports on the Scientific Results of the Expedition to the Tropical Pacific, in charge of ALEXANDER AGASSIZ, on the U. S. Fish Commission Steamer "Albatross," from August, 1899, to March, 1900, Commander Jefferson F. Moser, U. S. N., Commanding, as follows:—

R. V. CHAMBERLIN. The Annelids.

H. L. CLARK. The Holothurians.

— The Volcanic Rocks.

— The Coralliferous Limestones.

S. HENSHAW. The Insects.

G. W. MÜLLER. The Ostracods.

MARY J. RATHBUN. The Crustacea Decapoda.

G. O. SARS. The Copepods.

L. STEJNEGER. The Reptiles.

T. W. VAUGHAN. The Corals, Recent and Fossil.

A. WETMORE. The Mammals and Birds.



PUBLICATIONS  
OF THE  
MUSEUM OF COMPARATIVE ZOÖLOGY  
AT HARVARD COLLEGE.

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There have been published of the BULLETIN Vols. I. to LIV., LVI., and Vols. LVIII. to LX.; of the MEMOIRS, Vols. I. to XXXIV., and also Vols. XXXVI. to XXXVIII., XL. to XLII., XLIV., and XLVI.

Vols. LV., LVII., LXI. and LXII. of the BULLETIN, and Vols. XXXV., XXXIX., XLIII., XLV., XLVII. to XLIX. of the MEMOIRS, are now in course of publication.

The BULLETIN and MEMOIRS are devoted to the publication of original work by the Officers of the Museum, of investigations carried on by students and others in the different Laboratories of Natural History, and of work by specialists based upon the Museum Collections and Explorations.

The following publications are in preparation:—

Reports on the Results of Dredging Operations from 1877 to 1880, in charge of Alexander Agassiz, by the U. S. Coast Survey Steamer "Blake," Lieut. Commander C. D. Sigsbee, U. S. N., and Commander J. R. Bartlett, U. S. N., Commanding.

Reports on the Results of the Expedition of 1891 of the U. S. Fish Commission Steamer "Albatross," Lieut. Commander Z. L. Tanner, U. S. N., Commanding, in charge of Alexander Agassiz.

Reports on the Scientific Results of the Expedition to the Tropical Pacific, in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer "Albatross," from August, 1899, to March, 1900, Commander Jefferson F. Moser, U. S. N., Commanding.

Reports on the Scientific Results of the Expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer "Albatross," from October, 1904, to April, 1905, Lieut. Commander L. M. Garrett, U. S. N., Commanding.

Contributions from the Zoölogical Laboratory, Professor E. L. Mark, Director.  
Contributions from the Geological Laboratory, Professor R. A. Daly, in charge.

These publications are issued in numbers at irregular intervals. Each number of the Bulletin and of the Memoirs is sold separately. A price list of the publications of the Museum will be sent on application to the Director of the Museum of Comparative Zoölogy, Cambridge, Mass.





